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Materiel Test Procedure 4-3-046
U. S. Army Air Defense BoardU. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

DEMOLITIONS, ATOMIC

1. OBJECTIVE

The objective of this MTP is to describe the service test procedures required to determine the operational effectiveness of atomic demolitions and their associated activation equipment, measured against the requirements specified in the applicable Qualitative Materiel Requirement (QMR) or Small Development Requirement (SDR), and the suitability of such items for military use.

2. BACKGROUND

Military uses of nuclear energy tend to converge with non-military applications. Thus, in addition to strategic, air defense and anti-personnel roles, military applications are emerging in fields of power generation and demolition. Accordingly, devices having high yield of explosive energy per unit volume, together with secure means of activation will continue to be developed and improved. Evaluation of their military capabilities and limitations must therefore be conducted, preferably without the need to test the nuclear effects as part of testing in the field.

Comprehensive testing of non-nuclear features of atomic demolitions encompasses testing by service personnel subjecting the commodity items to all phases of transportation, emplacement, and functioning and exposing them to all applicable environments. Components of nuclear demolitions munitions typically are supplied by numerous independent developers who normally design and develop equipment to meet only those interface requirements established by competent Project Officer Groups. Coordination by the Test Officer of service test plans and activities with each developer is therefore especially necessary to ensure that, in addition to requirements specified in QMR, SDR, etc., the interface requirements of the system are met.

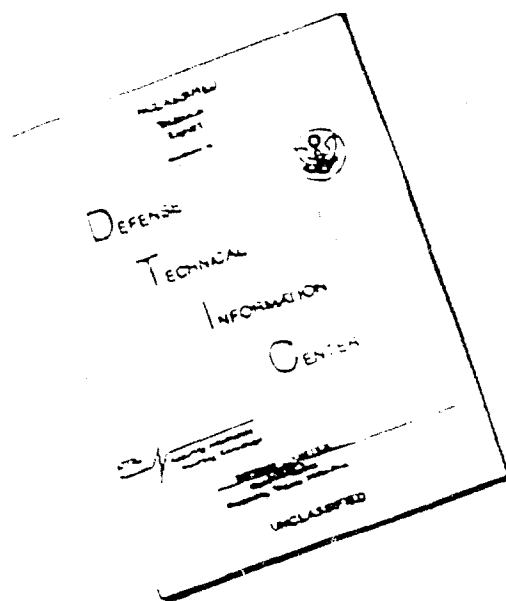
3. REQUIRED EQUIPMENT

- a. Appropriate tool sets and test sets.
- b. Suitable operational areas, transportation routes, and structures.
- c. Transport and instrumentation vehicles.
- d. Still, high speed, and motion picture cameras with associated photographic equipment (black and white and color).
- e. Communications equipment, radio and wire.
- f. Meteorological instrumentation
- g. Depth gage.
- h. Audio recorder.
- i. Interval timer.
- j. Appropriate simulators to represent interface requirements.
- k. Squibs and firing indicators.

4. REFERENCES

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QUALITY AVAILABLE. THE COPY
FURNISHED TO DTIC CONTAINED
A SIGNIFICANT NUMBER OF
PAGES WHICH DO NOT
REPRODUCE LEGIBLY.

- A. Military Standard MIL-STD-810, Environmental Test Methods.
- B. FM 3-15, Nuclear Accident Contamination Control.
- C. FM 5-25, Explosives and Demolitions
- D. FM 5-26, Employment of Atomic Demolition Munitions
- E. Army Regulation 70-10, Army Materiel Testing.
- F. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- G. Army Regulation 700-1300-8, Malfunctions Involving Ammunition and Explosives.
- H. USATECOM Regulation 705-10, Electronic Security During Research and Development (V).
- I. USATECOM Regulation 705-13, Research, Development, Test and Evaluation of Physical Security Equipment.
- J. Army Regulation 70-38, Research, Development, Test, and Evaluation of Materiel for extreme Climatic Conditions.
- K. USATECOM Regulation 705-25, Reliability Program for Materiel and Equipment.
- L. USATECOM Regulation 705-35, Criteria for Air Portability and Air Drop of Materiel.
- M. FM 9-6, Ammunition Service in the Theater of Operations.
- N. TM 9-1903, Care, Handling, Preservation and Destruction of Ammunition.
- O. Applicable QMR, SDR, TC, and Stockpile-to Target Sequence (STS).
- P. MTP 3-1-002, Confidence Intervals and Sample Sizes.
- Q. MTP 4-3-502, Durability and Reliability.
- R. MTP 4-3-504, User Reaction.
- S. MTP 4-3-505, Security.
- T. MTP 4-3-507, Ammunition Functioning.
- U. MTP 4-3-513, Maintenance.
- V. MTP 4-3-514, Safety Hazards.
- W. MTP 6-3-513, Qualitative Electromagnetic Interference

5. SCOPE

5.1 SUMMARY

5.1.1 Technical Characteristics

The procedures outlined in this MTP provide general guidance for determining the degree to which the test item meets current military requirements for atomic demolitions and their associated activation equipment. The cumulative test results, together with the results of appropriate Common Service Tests will allow an estimate to be made of the operational effectiveness of the item and the suitability of the equipment to meet the required military needs.

The specific tests to be performed, along with their intended objectives are listed below:

a. Operational Characteristics - The objective of this subtest is to:

- 1) Evaluate the degree of ease or difficulty associated with

- emplacing the test item in applicable situations.
- 2) Determine the vulnerability of the test item to detection by optical, radiological, and infrared surveillance.
- 3) Determine the susceptibility of the test item and its associated activating equipment to detection or interference in the electromagnetic radiation spectrum.
- 4) Determine the capability of the test item for deactivation and retrieval under battlefield conditions.
- 5) Evaluate the functioning of activating system components in conjunction with the test item.

b. Special Emplacement Capabilities - The objective of this subtest is to:

- 1) Evaluate the suitability and limitations of the test item for emplacement underwater in tactical situations.
- 2) Evaluate the effectiveness and limitations of the test item emplaced in tunnels, excavations and bores.

c. Transportability Evaluation - The objective of this subtest is to determine the suitability of the test item for movement over cross-country routes in tactical situations by means of man-portability and tactical vehicles.

d. Full-Test Evaluations - The objective of this subtest is to:

- 1) Determine the capability of average trained crews to accomplish the entire demolition mission with the test item.
- 2) Determine the responses of crew members, supporting personnel and associated military units to the availability, deployment, utilization and anticipated performance of the test item.
- 3) Evaluate the time in service, failure potential of components, and operational durability limits of the test item during transportation, emplacement and functioning.
- 4) Evaluate the accessibility and susceptibility of the test item, to the accomplishment of scheduled and non-scheduled maintenance tasks over the entire period of service testing, and of completeness and suitability of the maintenance package supplied.
- 5) Determine the safety hazards encountered during transportation, emplacement, functioning, and recovery of the test item throughout the period of testing.

5.1.2 Common Service Tests

Not included in this MTP are the following Common Service Tests which apply to these commodities:

- a. MTP 4-3-500, Preoperational Inspection and Physical Characteristics.
- b. MTP 4-3-501, Personnel Training.
- c. MTP 4-3-520, Field Storage.
- d. MTP 4-3-521, Training Manuals and Technical Publications.

- e. MTP 7-3-512, Airdrop Capability
- f. MTP 7-3-515, Air Transport, Internal
- g. MTP 7-3-516, Air Transport, External

5.2 LIMITATIONS

The variety of atomic demolitions and their associated activation equipment preclude detailed coverage of any particular item. The testing methods outlined are intentionally general to provide test coverage for various non-nuclear features of atomic demolition munitions, and may be adapted, as necessary, to accomodate specific items. It is left as a task for the project officer to select the applicable test procedures from those given herein in order to evaluate the complete system, including its means of activation.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Select and schedule suitable transportation and operational areas, including target installations, at representative environmental locations as required by applicable test directive, test procedure and corresponding MTP.

b. Upon establishing the scheduled availability of the test item, coordinate the availability of the following:

- 1) Engineering safety release or other safety statement.
- 2) Maintenance support facilities, spare parts, and personnel.
- 3) Equipment, special facilities and instrumentation with special attention to timely provision of additional supplies or special equipment not readily available at the test site.
- 4) The participation and/or assistance of representatives of the U. S. Army Materiel Command Field Office (USAMCFO) at the Defense Atomic Support Agency (DASA), Sandia Corporation, and U. S. Atomic Energy Commission (AEC) in the conduct of detonator tests.

c. Select test equipment having an accuracy of an order of magnitude greater than that afforded by the item under test, that is in keeping with the state of the art, and with calibrations traceable to the National Bureau of Standards.

d. Record the following information:

- 1) Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.
- 2) Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

e. Ensure that the necessary test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirement (QMR), Small Development Requirement (SDR), and Technical Characteristics (TC).

f. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous test conducted on the same types of equipment, and familiarize the necessary personnel with the contents of such documents. These documents shall be kept readily available for reference by the test officer and test NCO.

g. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation of the test item.

h. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test and that the item has successfully completed MTP 4-3-514, Safety Hazards.

i. Perform a storage inspection on each test item prior to and following each subtest according to the applicable training manual to assure a serviceable item continues in test.

j. Prior to beginning any subtest, verify correct power source, necessary test instrumentation and inter-connection cabling, and that the equipment is aligned, if necessary, as specified in the pertinent operating instructions to endure, insofar, as possible, it represents an average equipment in normal operating condition.

k. Prepare a test item sample plan sufficient to ensure that enough samples of all measurements are taken to provide statistical confidence of final data in accordance with MTP 3-1-002. Provisions shall be made for modification during test progress as may be indicated by monitored test results.

l. Ensure that appropriate security measures are instituted as required to safeguard classified materiel and data.

m. Prior to the start of each phase of testing and at appropriate intervals during the testing, record prevailing meteorological conditions to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Visibility
- 7) Wind speed and direction
- 8) Source of data

6.2 TEST CONDUCT

NOTE: Tests contained in paragraph 6.2.4. shall be performed concurrently with other tests to minimize the project elapsed time and to maximize utilization of facilities.

6.2.1 Operational Characteristics

6.2.1.1 Emplacement

6.2.1.1.1 Normal Conditions

a. Utilizing an average trained crew, emplace the item under test in

an applicable tactical situation.

b. Observe and record the activities and times required to:

- 1) Prepare the site, including excavation.
- 2) Dismount or otherwise make ready the test items, starting from the transportation configuration, and perform prefire operations.
- 3) Install the test items and communications equipment.
- 4) Arm or otherwise prepare the test item for activation.

c. Repeat Steps a and b above, at least three times, utilizing a different crew for each trial.

d. Repeat Steps a and b above, at least three times, rotating the crew assignment for each trial.

e. Repeat Steps a and b above, adding or subtracting one crew member for each trail, until the minimum and optimum crew sizes required to emplace the test item are established.

6.2.1.1.2 Adverse Conditions

a. Repeat the procedures of paragraph 6.2.1.1 above, under the following conditions, as applicable:

- 1) Darkness (Blackout).
- 2) Conditions not previously encountered in the course of testing to include:
 - a) Moderate temperatures with rain.
 - b) Frigid temperatures with:
 - (1) Snow
 - (2) Sleet or icing conditions
 - c) Hot temperatures with:
 - (1) High humidity
 - (2) Low humidity

6.2.1.2 Security From Detection

Subject the item under test to visual, radiological, and electromagnetic surveillance on the ground and from the air in accordance with the procedures given in MTP 4-3-505. Observations shall be conducted during transportation of the test item to its site and after it has been emplaced.

6.2.1.3 RF Security

Subject the item under test to electromagnetic interference and countermeasures in accordance with the procedures given in MTP 6-3-513.

6.2.1.4 Recoverability

a. Utilizing an average trained crew, recover the test item from an emplaced battlefield situation.

b. Observe and record the activities and times required to:

- 1) Disarm or otherwise inactivate
- 2) Remove from emplacement
- 3) Make ready for transportation and/or re-emplacement

c. Repeat Steps a and b above, at least three times utilizing a different crew for each trial.

d. Repeat Steps a and b above, at least three times rotating the crew assignments for each trial.

e. Repeat Steps a thru d above, under the conditions outlined in paragraph 6.2.1.1.2.

6.2.1.5 Component Functioning

a. Subject the test item and its activating system to the procedures given in MTP 4-3-507.

b. From testing of the complete item observe and record insofar as possible the performance of the following:

- 1) Detonator
- 2) Firing Device
- 3) Initiator
- 4) Remote firing Equipment
- 5) Special Options

6.2.2 Special Emplacement Capabilities

a. Repeat the procedures outlined in paragraph 6.2.1.1, submerging the item under test in reservoirs, lakes, streams, or in the ocean and ocean harbors, as applicable

b. Record water temperature in degrees F and C in addition to the data specified in paragraph 6.2.1.1.

c. Repeat the procedures outlined in paragraph 6.2.1.1, emplacing the test item underground in caves, tunnels, bore shafts, or excavations, as applicable.

6.2.3 Transportability Evaluation

6.2.3.1 Man Portability

a. Utilizing average trained test soldiers dressed in full field uniforms, and personal equipment, man-carry the test item from a supply point to an emplacement site under daylight conditions.

b. Observe and record activities and times required to traverse five miles each of cross-country terrain having the following characteristics, as applicable:

- 1) Heavy vegetation

- 2) Marsh
- 3) Rocks and ledges
- 4) Sand fields
- 5) Stream beds
- 6) Slopes

c. Repeat Steps a and b above, at least five times varying the size of crews for each trial.

d. Record optimum minimum crew size required to minimize transit time without compromise to security from detection.

e. Repeat Steps a, b, c and d above, under conditions of darkness (blackout).

6.2.3.2 Vehicle Delivery

a. Utilizing appropriate tactical vehicles, transport the test item from a supply point to an emplacement site under daylight conditions.

b. Observe and record activities and times required to traverse the following applicable routes, for the distances noted:

- 1) Pavement - 50 miles
- 2) Secondary roads - 100 miles
- 3) Cross-country terrain - 50 miles

c. Repeat Steps a and b above, under conditions of darkness (blackout).

6.2.4 Full-Test Evaluations

6.2.4.1 Operability

a. Observe and record activities and average times of phases of the demolition missions as conducted under paragraphs 6.2.1, 6.2.2, and 6.2.3 of this MTP.

b. Throughout the entire test conduct, record narrative comments pertaining to the capability of the test item to accomplish complete missions in applicable combinations of the mission phases, ambient conditions and terrain as experienced in the tests.

6.2.4.2 User Reaction

a. Determine and record the responses of crew members and supporting personnel in accordance with the procedures given in MTP 4-3-504.

b. If other military units are associated with operations in conjunction with employment of the test item, determine and record characteristic reactions of representative personnel.

6.2.4.3 Durability and Reliability

a. Throughout the entire test period, monitor the durability and

reliability characteristics of the test item in accordance with the procedures given in MTP 4-3-502. Ensure that the test item has been subjected to at least the following exposures:

- 1) Man carried, cross-country - 25 miles
- 2) Transport vehicles, paved roads - 500 miles
- 3) Transport vehicles, secondary roads - 1000 miles
- 4) Tactical vehicles, cross-country - 100 miles

b. In addition to the data specified in MTP 4-3-502, observe and record at 100-mile intervals, or at the end of the exposure, the incidence of defects in the test item and its components, including:

- 1) Inoperable electronic equipment (damaged enclosures, loose or broken connections, foreign material accumulations, damaged components).
- 2) Damaged or worn mechanical parts, to include component packaging, (bent or broken handles and fasteners, defective seals, sluggish or restrained mechanical action).

6.2.4.4 Maintainability

a. Throughout the conduct of all testing as outlined in this MTP, maintain a record of performance of scheduled and unscheduled maintenance as prescribed in the appropriate draft publications.

b. Compare all replacement parts and components provided with the test item with anticipated and actual requirements, evaluating spare parts requirements under actual operating conditions.

c. Record the requirements for additional tools and instruments, shortcomings in authorized tools and instruments, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

d. Record all repair parts used, man hours and elapsed time required and level of skill demanded.

6.2.4.5 Safety Confirmation

a. Throughout the conduct of all testing as outlined in this MTP, monitor all safety aspects associated with the test item in accordance with the procedures given in MTP 4-3-514.

b. In addition to data required by MTP 4-3-514, record narrative comments concerning the following:

- 1) Confirmation of safety release under conditions as specified in USATECOM Regulation 385-6.
- 2) Analysis to establish that no foreseeable hazards are present during testing or operation of the test item.
- 3) Inspection for high voltage hazard control and adequacy of protective provisions to include interlocks and warning placards.
- 4) Evaluation of any safety hazards, including radiological

hazards, associated with storage, transportation, operation, and maintenance of the test item.

6.3 TEST DATA

6.3.1 Preparation for Test

Data to be recorded prior to testing shall include but not be limited to:

- a. Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.
- b. Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.
- c. Damages to the test item incurred during transit and/or manufacturing defects.
- d. Prevailing meteorological conditions prior to start of test and at appropriate intervals thereafter to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Wind speed and direction
- 7) Visibility
- 8) Source of data

6.3.2 Test Conduct

Data to be recorded in addition to specific instructions listed below for each subtest shall include:

- a. A block diagram of the test setup employed in each specified test. The block diagram shall identify by model and serial number, all test equipment and interconnections (cable lengths, connectors, attenuators, etc.) and indicate control and dial settings where necessary.
- b. Photographs or motion pictures (black and white or color), sketches, charts, graphs, or other pictorial or graphic presentations which will support test results or conclusions.
- c. An engineering logbook containing, in chronological order, pertinent remarks and observations which would aid in a subsequent analysis of the test data. This information may consist of temperatures, humidity, pressures, and other appropriate environmental data, or other description of equipment or components, and functions and deficiencies, as well as theoretical estimations, mathematical calculations, test conditions, intermittent or catastrophic failures, test parameters, etc., that were obtained during the test.
- d. Test item sample size (number of measurement repetitions).
- e. Instrumentation or measurement system mean error stated accuracy.

6.3.2.1 Operational Characteristics

6.3.2.1.1 Emplacement

- a. Record times for accomplishment of test phases under assigned conditions, in minutes.
- b. Record activities on motion picture film as required.

6.3.2.1.2 Security

Record data in accordance with MTP 4-3-505.

6.3.2.1.3 RF Security

Record data in accordance with MTP 6-3-513.

6.3.2.1.4 Recoverability

- a. Record times for accomplishment of test phases under assigned conditions in minutes.
- b. Record activities on motion picture film as required.

6.3.2.1.5 Component Functioning

- a. Record data in accordance with MTP 4-3-507,
- b. Record detonator functioning on appropriate recorders.
- c. Record on oscillograph on other multi-channel recorder the action of initiator and response of firing device.

6.3.2.2 Special Emplacement Capabilities

- a. Record data as outlined in paragraph 6.3.2.1.1.
- b. Record water temperature in degrees F.

6.3.2.3 Transportability Evaluation

6.3.2.3.1 Man Portability

- a. Record times for accomplishment of transit under assigned conditions in minutes.
- b. Record activities on motion picture film as required.

6.3.2.3.2 Vehicle Delivery

Record transit speeds in miles per hour, annotated to define type of terrain and mode of transport.

6.3.2.4 Full-Test Evaluation

6.3.2.4.1 Operability

- a. Record test phases on motion picture film.
- b. Record times of accomplishment of phases in hours and minutes.
- c. Record narrative comments pertaining to the capability of the test item to complete missions under all assigned conditions.

6.3.2.4.2 User Reaction

Record data in accordance with MTP 4-3-504.

6.3.2.4.3 Durability and Reliability

- a. Record data in accordance with MTP 4-3-502.
- b. Record incidence of defects in the test item and its components at specified intervals.

6.3.2.4.4 Maintainability

- a. Record performance of scheduled maintenance.
- b. Record the requirements, shortcomings, and needs for tools and instruments.
- c. Record all spare parts used, man hours and elapsed time required, and level of skill demanded.

6.3.2.4.5 Safety Confirmation

- a. Record data in accordance with MTP 4-3-514.
- b. Record narrative comments concerning confirmation of safety release, analysis for foreseeable hazards, results of inspection for high voltage hazards, and evaluation of safety hazards associated with operation and test of the item.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification, security classification, correlation, and grouping the test data according to subtest title. Test criteria or test item specifications shall be noted on the test data presentation to facilitate analysis and comparison. Where necessary, test data measurement units shall be converted to be compatible with units given by test criteria or specifications.

Data, including observations and comments of operators, obtained from each section under Test Conduct, shall be summarized, compared, and evaluated according to procedures described in the individual referenced MTP's or equivalent current practice where not covered by MTP's. Appropriate charts, graphs and tables shall be used to display summaries and comparisons of test data. Coordinates and other features of graphs and tables will be selected for clarity, and uniformity with like presentation shall be given to any condition or circumstance which may have significantly influenced the test results.

Efforts will be maintained to take advantage of digital data recording, automatic data processing and automatic data read-out.

Calculations shall be performed as specified by the individual referenced MTP's, or in accordance with equivalent current practice when not covered by MTP's. All photographs, motion pictures, audio tapes and other records shall be explicitly identified and referenced; significant frames, transcriptions and samples shall be selected for illustrative purposes. All illustrations shall be completely identified.

All qualitative data accumulated shall be evaluated against the QMR or SDR to determine the degree of fulfillment demonstrated, compared with performance specifications.

Data collected under adverse weather conditions shall be separately compared with data collected during normal weather conditions.